Space Weather Technical Forecast

Issued on Friday, 27 January 2023 at 12:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Decreasing chance of R1/R2 Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate over the past 24 hours with a M2.8 flare observed at 26/1306 UTC from AR3192, which has now rotated behind the west limb. This leaves seven numbered sunspot regions on the visible disc. However, all regions are small, weak and magnetically simple, and either stable or showing slight decay.

No Earth-directed CMEs were detected in available imagery. However, a prominence lift-off from the far southwest late on 26th is being modelled to confirm initial analysis that the associated CME is off the Sun-Earth line.

Solar Wind / Geomagnetic Activity: The solar wind has been at mostly elevated levels between 480-580 km/s. Density was average or slightly above. The total IMF, Bt, was Weak to Moderate, occasionally reaching 9nT. The north-south component, Bz, was predominantly weak, varying between +9 nT and -7nT. The phi angle was mainly positive, (away from the Sun), with a brief fluctuation to become negative (towards the Sun) in the evening UTC of the 26th. Geomagnetic Activity was Quiet to Unsettled (Kp 0-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has been at Background levels throughout. High energy electron flux (greater than 2 MeV) has been at Background to Moderate. The associated 24-hour integrated electron fluence stayed well below the Active threshold, with a gradual decreasing trend, and 6.21 e6 integrated pfu was observed at 27/0001 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be predominantly Low, with a slight but decreasing chance of Moderate-class flares, as previous large and active regions have now rotated onto the far side.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in this forecast. Solar winds are currently elevated due to the influence of the fast winds of CH69/+. Little change is expected today and much of tomorrow, as tomorrow there is a chance of a further weak enhancement in the solar wind from CH71/+. From day 3 (29th) the solar wind is expected to decline to slightly elevated levels. Geomagnetic activity is expected to be Quiet with Unsettled (Kp 1-3) for much of the period, but with a chance of isolated Active (Kp 4) intervals, and a slight chance of G1/Minor Storms (Kp 5) today and tomorrow.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES16 is likely to remain at predominantly Background levels. However, initially there is just a slight chance of an enhancement through today, due to the residual risk from AR3190 and AR3192 which have now rotated onto the far side. Electron flux will start at Normal

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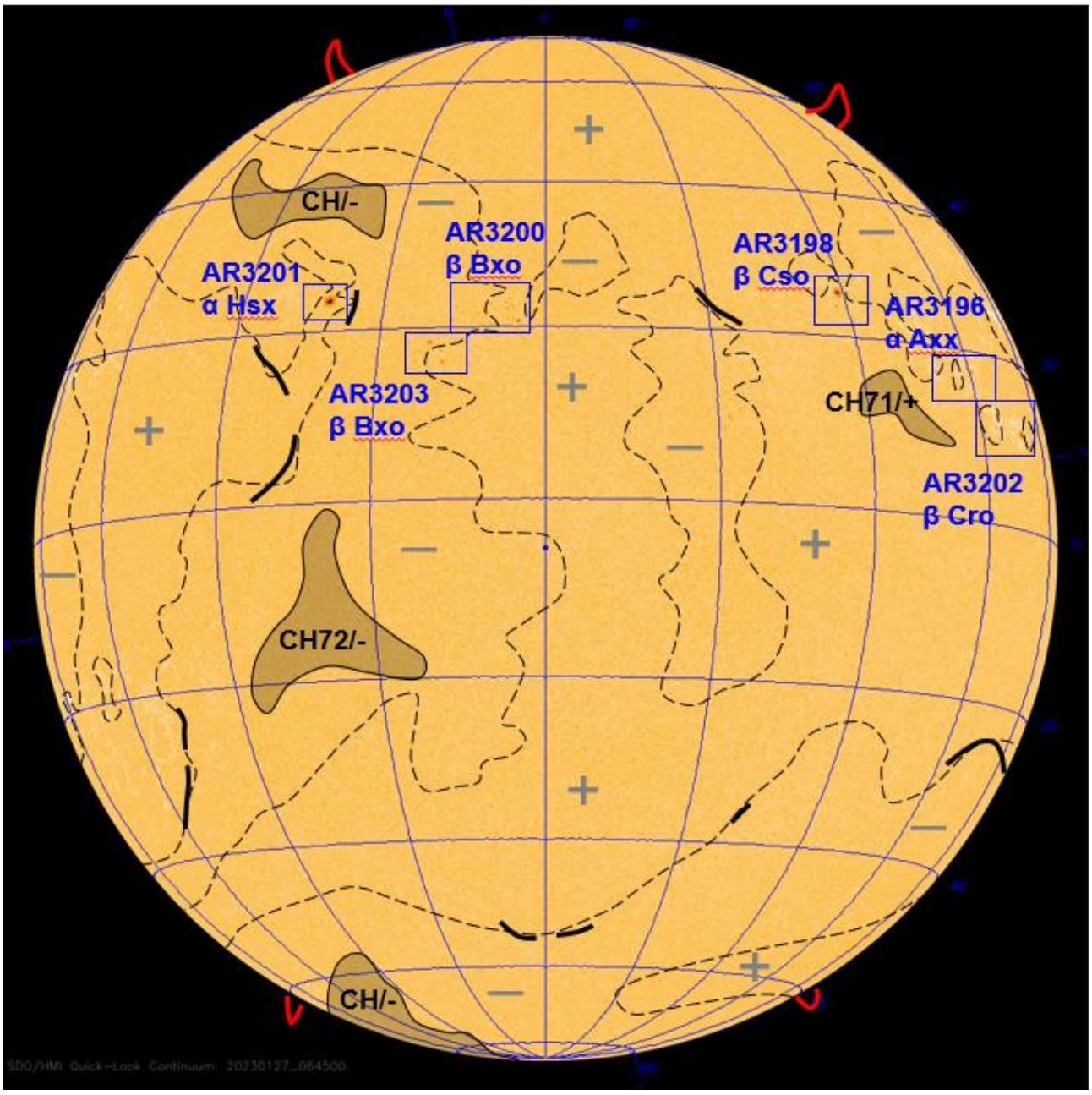
Background to Moderate levels, but is likely to increase later in the period response to coronal hole influences. However, despite the expected rising trend through the period, the fluence is likely to remain below the Active threshold (1e8 integrated flux) as the starting levels are so low. Therefore only a slight chance of Active fluence is expected, mainly from day 3 (29th).

Figure 1. Solar Analysis Valid 27/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The forecast period currently features no Earth-directed CMEs.

Earth is currently under the influence of a high speed stream (HSS) from CH69. A further slight enhancement may occur tomorrow, due to a weak HSS from CH71, which is now a small and barely discernible feature. Therefore today and tomorrow mainly elevated solar wind speeds are expected, with a decline to slightly elevated speeds from day 3 (29th). However, looking at persistence from the previous rotation, there is a chance of the solar wind briefly reaching strong levels today or tomorrow.

Geomagnetic activity is expected to be Quiet with Unsettled (Kp 1-3) for much of the period, but with a chance of isolated Active (Kp 4) intervals and a slight chance of G1/Minor Storms (Kp 5) today and tomorrow.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	10	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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Radio Blackouts - X-Ray Flares:

Overall activity levels are expected to continue to decrease as the sources of the recent Moderate activity, AR3190 and AR3192, continue rotating further across the far side of the Sun. The current remaining six regions are all small, weak and magnetically simple, with plage regions at the southeast and northeast limb producing some C-class flaring. Far-sided products indicate that possible active regions may rotate onto the visible disc within the next few days, with a brighter area on STEREO-A EUVI in the south, showing the possible return of ex-AR3181.

Overall, activity is likely to be predominantly Low, but with a chance of M-class flares today and then a slight chance of M-class flares thereafter.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	20	10	10	10
Very Active	R3 to R5 X Class	No	5	1	1	1

Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) protons as observed by GOES-16 are currently forecast to persist at background levels, but with an initial slight chance of rising in response to any significant flaring, and perhaps approaching the S1 level.

This is most likely to come from AR3190, which has now rotated onto the far-side. Despite this, any notable flaring from this region will continue to bring a potential for increased proton flux through today (27th). Despite the large number of other active regions on the disc, these are all smaller and simpler, with a lower risk of proton rich flaring.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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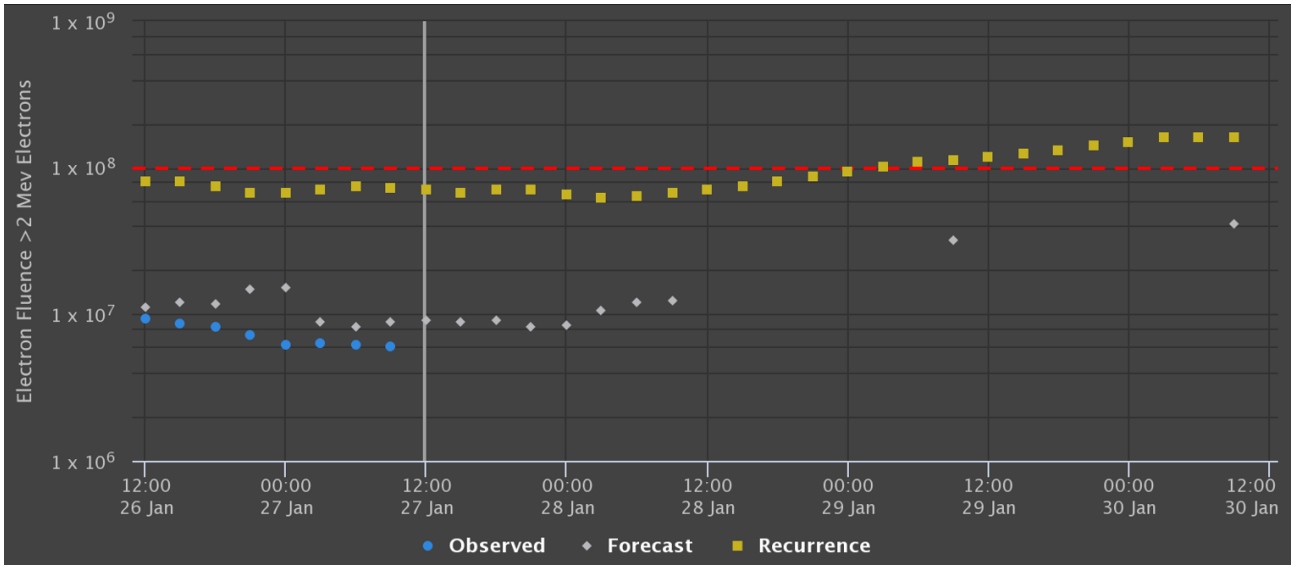
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) will start at Normal Background to Moderate levels, but are likely to increase to predominantly Moderate levels later in the period response to the current high speed stream from CH69, and potentially a further slight enhancement from CH71 tomorrow.

The associated 24 hour fluence is forecast to stay below the Active (1e8 integrated flux) threshold throughout, but with an increasing although trend. This is supported by REFM which indicates a gradual rising trend, well below the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: MOSWOC REFM.



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